Comparison of Topics Covered in Grade 11 Mathematics Assessments:
NAEP (Grade 12), ITED, ICAM, ITED Constructed Response

Iowa K-12 Core Content Standards and Benchmarks Corresponding to the Iowa Tests: Math Content Standards	**NAEP Grade 12 Mathematics Format: Contains both selected response and constructed response items (NAGB, not dated)**		**ITED Level 17/18 Mathematics: Concepts and Problem Solving (40 questions) Format: Contains selected response items only (ITP, 2003)**		**ICAM: Eleventh-Grade Mathematics includes 7 modules: Problem-Solving Strategies and Process; Number Concepts and Operations; Measurement; Geometry; Data Interpretation, Statistics, and Probability; Patterns, Functions, and Algebra; Solving Work-Related Math Problems Format: Contains both selected response and constructed response items (ICM, 2003)**		**ITED Constructed Response Supplement: Thinking about Mathematics, Level 17/18 Format: Contains constructed response items only (ITP, not dated)**	
A. Students can understand and apply a variety of math concepts.	**Number Sense, Properties, and Operations**	20%-50%	**Numbers and Operations on Numbers**	19 questions	**Number Concepts and Operations**	20 points	**Concepts and Procedures**	4 points
	Relate counting, grouping, and place value -Use place value to model and describe whole numbers and decimals -Use scientific notation in meaningful contexts		Understanding mathematical concepts and procedures: select appropriate procedures; identify examples and counterexamples of concepts (7 questions)		Understands number concepts associated with the real number system (Number Concepts and Operations, 1 point)			
	Represent numbers and operations in a variety of equivalent forms using models, diagrams, and symbols -Use two- and three-dimensional region models to describe numbers -Use other models as appropriate -Read write, rename, order, and compare numbers				Understands the characteristics, properties, and uses of roots, exponents, and scientific notation and the relationships among them and their equivalent representations (3 points)			
	Compute with numbers (that is, add, subtract, multiply, divide) -Apply basic properties of operations -Describe effect of operations on size and order of numbers				Understands the properties of operations with real numbers and the correct order of operations for performing arithmetic computations (Number Concepts and Operations, 1 point)			

	-Describe features of algorithms -Select appropriate computation method							
A1. Understand and apply number properties and operations. B. Students can understand and apply methods of estimations. B1. Students can understand and apply concepts and procedures of standard rounding, order of magnitude, and number sense. C. Students can solve a variety of math problems. C1. Students can solve math problems requiring multiple steps and operations. C2. Students can reason quantitatively.	Use computation and estimation in applications -Round whole numbers, decimals, and fractions in meaningful contexts -Make estimates appropriate to a given situation -Select appropriate method of estimation -Solve application problems involving numbers and operations using exact answers or estimates as appropriate -Interpret round-off errors using calculators/computers -Verify solutions and determine the reasonableness of results		Computation involving integers (9 questions) Computation involving decimals and percents (8 questions) Computation involving fractions (5 questions) Problem Solving: Reason quantitatively, evaluate reasonableness of solutions (19 questions)		Solves problems using number concepts (10 points) **Problem-Solving Strategies and Process** Understands the relationship between the language of mathematics and real-word situations (Problem-Solving Strategies and Process, 3 points) Uses strategies to understand and solve problems (Problem-Solving Strategies and Process, 7 points) Identifies relevant, irrelevant, and missing information needed to solve the problems (Problem-Solving Strategies and Process, 2 points) Understands the process of mathematical justification and constructs logical verifications or counterexamples to test conjectures (Problem-Solving Strategies and Process, 8 points) **Solving Work-Related Math Problems** Solves work-related mathematics problems using a variety of mathematical concepts and computations (Solving Work-Related Math Problems (20 points)	20 points 20 points	**Solving Problems**	10 points
	Apply ratios and proportional thinking in a				Understands the concepts of fraction, ratio, proportion,			

	variety of situation -Use ratios to describe situations -Use proportions to model problems -Use proportional thinking to solve problems -Understand the meaning of percentage -Solve problems involving percentages				and percent, the relationships among them, and their equivalent representations (Number Concepts and Operations, 5 points)			
	Use elementary number theory -Describe odd and even numbers and their characteristics -Describe number patterns -Use factors and multiples to model and solve problems -Describe prime numbers -Use divisibility and remainders in problem settings (including simple modular arithmetic)							
A3. Students can understand and apply concepts of geometry and measurement.	**Measurement**	15%			**Measurement**	18 points		
	Estimate the size of an object with respect to a given measurement attribute (e.g., length or perimeter).							
	Select and use appropriate measurement instruments such as ruler, meter stick, clock, thermometer, or other scaled instruments.							
	Select and use appropriate units of measurement according type and size of							

	unit							
	Estimate, calculate or compare perimeter, area, volume, and surface area in meaningful contexts to solve mathematical and real-world problems -Solve problems involving perimeter and area -Solve problems involving volume and surface area				Solves problems involving perimeter, circumference, area, volume, and surface area of geometric shapes (Measurement, 5 points) Estimates quantities and measurements (Measurement, 1 point)			
	Apply given measurement formulas for perimeter, area, volume, and surface area in problem settings							
	Convert from one measurement to another within the same system							
	Determine precision, accuracy, and error -Apply significant digits in meaningful contexts -Determine appropriate size of unit of measurement in problem situation -Apply concepts of accuracy of measurement in problem situations -Apply absolute and relative error in problem situations							
	Make and read scale drawings							
	Select appropriate methods of measurement (such as direct or indirect)				Selects and uses and appropriate direct or indirect method of measurement in a given situation (Measurement, 6 points)			
	Apply the concept of rate to measurement situations				Solves problems involving rate as a measure (Measurement, 6 points)			

A3. Students can understand and apply concepts of geometry and measurement.	**Geometry**	20%	**Geometry/Measurement**	7 questions	**Geometry**	20 points		
	Describe, visualize, draw, and construct geometric figures -Draw or sketch a figure given a verbal description (open-ended items) -Given a figure, write a verbal description of its geometric qualities				Understands the properties of lines, angles, planes, and two- and three-dimensional figures and knows geometric language for describing and naming them (Geometry, 2-3 points)			
	Investigate and predict results of combining, subdividing, and changing shapes							
	Identify the relationship (congruence, similarity) between a figure and its image under a transformation -Use motion geometry -Use transformations							
	Describe the intersection of two or more geometric figures -two dimensional -Planar cross-section of a solid							
	Classify figures in terms of congruence and similarity, and informally apply these relationships using proportional reasoning where appropriate							
	Apply geometric properties and relationship in solving problems -Use the Pythagorean relationship to solve problems				**Uses the Pythagorean Theorem and its converse and properties of special right triangles to solve problems (Geometry, 6-7 points)**			

	-Apply properties of ratio and proportion with respect to similarity -Solve problems involving right triangle trigonometric applications							
	Establish and explain relationships involving geometric concepts -Make conjectures -Validate and justify conclusions and generalizations -Use informal induction and deduction				**Uses graphic representations to solve geometric problems involving the symmetry and transformations of figures or problems involving distance, midpoint, and slope (Geometry, 5 points)**			
	Represent problem situations with geometric models and apply properties of figures in meaningful contexts to solve mathematical and real-world problems				**Solves problems using properties of and relationships among geometric figures (Geometry, 6 points)**			
	Represent geometric figures and properties algebraically using coordinates and vectors -Use properties of lines to describe figures algebraically -Algebraically describe conic sections and their properties -Use vectors in problem situations							
A4. Students can understand and apply concepts in probability and statistics.	**Data Analysis, Statistics, and Probability**	20%	**Data Analysis, Probability, and Statistics**	10 questions	**Data Interpretation, Statistics, and Probability**	19 points	**Interpreting Information**	5 points
D. Students can interpret data presented in a variety of ways. D1. Students can make inferences	Read, interpret, and make predictions using tables and graphs -Read and interpret data -Solve problems by		Make inferences or predictions based on data or information; interpret data from a variety of sources (14 questions)		Reads and interprets data in charts, tables, plots, and graphs and understands how the reader's bias, measurement error, and display distortion can affect			

based on data presented in a variety of ways. D2. Students can interpret data from a variety of sources.	estimating and computing with data -Interpolate or extrapolate from data		Data Interpretation: Make inferences or predictions based on data or information; interpret data from a variety of sources (14 questions)		the interpretation of data (Data Interpretation, Statistics, and Probability, 3 points)			
	Organize and display data and make inferences -Use tables, histograms, pictograms, and line graphs -Use circle graphs and scattergrams -Use stem-and-leaf plots and box-and-whisker plots -Make decisions about outliers				Organizes and displays data using tables and graphs and uses the data to solve problems (Data Interpretation, Statistics, and Probability, 4 points)			
	Understand and apply sampling, randomness, and bias in data collection -Given a situation, identify sources of sampling error -Describe a procedure for selecting an unbiased sample -Make generalizations based on sample results							
	Describe measure of central tendency and dispersion in real-world situations				Understands measures of central tendency and variability and their applications to specific situations (Data Interpretation, Statistics, and Probability, 6-7 points)			
	Use measures of central tendency, correlation, dispersion, and shapes of distributions to describe statistical relationships -Use standard deviation and variance -Use the standard normal							

	distribution -Make predictions and decisions involving correlation							
	Understand and reason about the use and misuse of statistics in our society -Given certain situations and reported results, identify faulty arguments or misleading presentations of the data -Appropriately apply statistics to real-world situations				Understands how concepts of representativeness, randomness, and bias in sampling can affect experimental outcomes and statistical interpretations (Data Interpretation, Statistics, and Probability, 1 point)			
	Fit a line or curve to a set of data and use this line or curve to make predictions about the data, using frequency distributions where appropriate							
	Design a statistical experiment to study a problem and communicate the outcomes							
	Use basic concepts, trees, and formulas for combinations, permutations, and other couting techniques to determine the number of ways an event can occur							
	Determine the probability of a simple event -Estimate probabilities by use of simulations -Use sample spaces and the definition of probability to describe events -Describe and make predictions about expected outcomes							
	Apply the basic concept of probability to real-world				Determines probability using			

	probability to real-world situations -Use probabilistic thinking informally -Use probability related to independent and dependent events -Use probability related to simple and compound events -Use conditional probability				mathematical/theoretical models and understands the concepts of independent and dependent events and how they are related to conditional probability (Data Interpretation, Statistics, and Probability, 4-5 points)			
A2. Students can understand and apply concepts and procedures of algebra.	**Algebra and Functions**	25%	**Algebraic Concepts**	4 points	**Patterns, Functions, and Algebra**	17 points		
	Describe, extend, interpolate, transform, and create a wide variety of patterns and functional relationships -Recognize patterns and sequences -Extend a pattern of functional relationship -Given a verbal description, extend or interpolate with a pattern -Translate pattems from one context to another -Create an example of a pattern or functional relationship -Understand and apply the concept of a variable				Represents functions, patterns, and relationships using a variety of models (Patterns, Functions, and Algebra, 6 points)			
	Use multiple representations for situations to translate among diagrams, models, and symbolic expressions							
	Use number lines and rectangular coordinate							

	systems as representational tools -Identify or graph sets of points on a number line or in a rectangular coordinate system -Identify or graph sets of points in a polar coordinate system -Work with applications using coordinates -Transform the graph of a function							
	Represent and describe solutions to linear equations and inequalities to solve mathematical and real-world problems -Provide solution sets of whole numbers -Provide solution sets of real numbers				Uses expressions, equations, and inequalities to represent variable quantity situations (Patterns, Functions, and Algebra, 5 points)			
	Interpret contextual situations and perform algebraic operations on real numbers and algebraic expressions to solve mathematical and real-world problems -Perform basic operations, using appropriate tools, on real numbers in meaningful contexts -Solve problems involving substitution in expressions and formulas -Solve meaningful problems involving a formula with one variable -Use equivalent forms to solve problems		Computation involving algebraic manipulations (8 questions)		Solves problems using algebraic concepts and procedures (Patterns, Functions, and Algebra, 4-5 points)			
	Solve systems of equations and inequalities using							

	appropriate methods -Solve systems graphically -Solve systems algebraically -Solve systems using matrices							
	Use mathematical reasoning -Make conjectures -Validate and justify conclusions and generalizations -Use informal induction and deduction							
	Represent problem situations with discrete structures -Use finite graphs and matrices -Use sequences and series -Use recursive relations							
	Solve polynomial equations with real and complex roots using a variety of algebraic and graphical methods and using appropriate tools							
	Approximate solutions of equations							
	Use appropriate notation and terminology to describe functions and their properties				Understands appropriate terminology and notation used to define functions and their properties (Patterns, Functions, and Algebra, 1-2 points)			
	Compare and apply the numerical, symbolic, and graphical properties of a variety of functions and families of functions, examining general parameters and their effect on curve shape							
	Apply function concepts to model and deal with real-							

	world situations							
	Use trigonometry -Use triangle trigonometry to model problem situations -Use trigonometric and circular functions to model real-world phenomena -Apply concepts of trigonometry to solve real-world problems							